DOCUMENT RESUME

ED 268 754 EC 182 358

AUTHOR Rogers, Karen B.
TITLE Do the Gifted Think and Learn Differently? A Review of Recent Research and Its Implications for Instruction.
PUB DATE 2 Apr 86
NOTE 49p.; Paper presented at the Annual Convention of the Council for Exceptional Children (64th, New Orleans, LA, March 31-April 4, 1986).
PUB TYPE Information Analyses (070) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Cognitive Development; *Cognitive Processes; *Cognitive Style; Elementary Secondary Education; Field Dependence Independence; *Gifted; Interpersonal Competence; Problem Solving

ABSTRACT

Research on the nature of gifted children's learning is reviewed. Studies are cited on the following topics: cognitive style (learning style preferences, field independence/dependence, locus of control, and hemispheric specialization), cognitive development (differentiated stage development), cognitive strategy selection (components of problem solving); and social and emotional characteristics (interpersonal sensitivity, social cognition). Environmental factors influencing giftedness are cited, including exposure to content, practice in divergent thinking, critical analysis techniques, and communications skills development. An annotated reference list is appended. (CL)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION
CENTER (ERIC)
This document has been reproduced as received from the person or organization originating it.
Minor changes have been made to improve reproduction quality.
Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

ED268754

Do the Gifted Think and Learn Differently?
A Review of Recent Research and Its Implications For Instruction

Karen B. Rogers
College of St. Thomas
Graduate Studies in Education

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Karen B. Rogers
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Presentation at Annual Meeting of
Council for Exceptional Children (TAG Division)
New Orleans, April 2, 1986

EC182358

Do the Gifted Think and Learn Differently?
A Review of Recent Research and Its Implications
For Instruction

Introduction

At a time of increasing interest in giftedness, there has been a corresponding increase in the number of theories concerning its nature. Definitions abound in almost infinite numbers, each with its own "agenda" of so-called characteristics that differentiate the gifted from other learners.

Are these characteristics differences in performance excellence, as described by the United States Office of Education?

> A learner will be defined as gifted... if he/she is exhibiting outstanding performance or capable of exhibiting outstanding performance in one or more of the following areas: (1) general intellectual; (2) specific academic aptitude; (3) visual/performing arts; (4) creative production; and, (5) leadership.

Or are these characteristics differences in the cognitive, affective, physical, social, emotional, and intuitive domains, as exhaustively listed in the form of behavioral checklists by Clark (1980), Renzulli (1975 and later), and others?

Or are these characteristics due to differences in learning or developmental rates, as suggested by many researchers in the field (for example, Sternberg, 1982; Zelniker, Openheimer & Renan, 1975; Carmean, 1982)?

Or, finally, is there really no difference at all, as suggested by Benjamin Bloom (1976):

> We have developed elaborate myths about human variability... a large proportion of the great "talents" we have come to recognize in most fields of human endeavor did not just happen, did not come about purely by chance or were "discovered" by someone at maturity... "instant genius" is largely a fiction of the mass media.

Thus, while curriculum and instructional developers state with varying degrees of confidence that the gifted learner is different, no specific differences have been consistently enumerated. For this reason, a thorough review of research covering the work of the past ten years was undertaken in the hope that consistent differences might be found. Four questions were posed in the attempt to review the research on giftedness during this period of time:

1. Do the gifted possess differing cognitive styles than other learners?
2. Do the gifted differ in the ages or stages of cognitive development in some way?
3. Do the gifted differ in the cognitive strategies they select and use in problem-solving tasks?
4. Do the gifted differ in emotional or social characteristics connected with the academic setting?

A two-year (1983-1984) manual search through Gifted Child Quarterly, Child Development, Journal of Genetic Psychology, G/C/T, and Review of Educational Research produced a list of 30 potentially applicable articles. A computer search of the ERIC, ECER, and PSYCHINFO databases produced an additional 112 articles. Table One lists the number of articles pertaining to

each of the questions addressed in this review.

Insert Table One About Here.

Review of Research

Cognitive Style. Cognitive style, for the purposes of this review was defined as consistencies in the unique manner in which a learner acquires or processes information. Corresponding to this definition, then, four different types of cognitive style were found in the research: (1) learning style preferences; (2) field independence/dependence; (3) locus of control; and, (4) hemispheric specialization.

Learning Style Preference. Much research exists on differing learning styles as the basis for individual differences in learning. In support of the learning styles movement, it is argued that no single instructional process can provide optimal learning for all students. Although this would seem to be strength enough to argue for the differentiation of curriculum for the gifted learner, it would also suggest that each gifted learner is "different" and has little in common with other gifted, let alone normal, learners.

What constitutes learning style is also a question in this body of literature. A wide variety of directions and definitions have been pursued in learning styles research as applied to the gifted learner. Many researchers have defined learning style characteristics as variable preferences for differing: (1) learning environment conditions, such as sound, lighting,

temperature, and design of learning space; (2) emotional conditions, such as persistence, motivation, responsibility for helping others learn, and content structure; (3) sociological conditions, such as group, team, paired, adult, and individual modes; and, (4) physical conditions, such as perception, need for intake, time of day for maximum learning, energy levels, and need for mobility. Dunn & Dunn (1980), for example, have found that six of these eighteen variables discriminated between groups of gifted and nongifted learners. The gifted differed significantly from their nongifted peers in preferences for: (1) formal classroom design; (2) less structure in learning materials; (3) auditory mode presentations, especially when combined with (4) the kinesthetic modality; (5) less responsibility for the learning achievement of peers; and, (6) opportunity to complete tasks initiated. In synthesizing the findings of this research direction, Dunn, Dunn & Price (1981) concluded that the underlying learning style difference in gifted learners was their independence of thought and action, leading to a task-oriented persistence and less need for content structure, in addition to a resistance to the potential distractions that responsibility for others and an "open" classroom structure might include. It was suggested, furthermore, that this independence might also explicate the pairing of the auditory and kinesthetic modalities; the gifted learner may find an auditory presentation alone too restrictive and slow because of a more rapid learning pace. Addition of the kinesthetic mode may allow them active

involvement with concepts so that they can criticize, extrapolate and concentrate on ideas rather than to merely listen.

Stewart (1981) corroborated this underlying factor of independence in her studies of several hundred elementary students. In measuring the instructional technique preference differences of this group, she found an overwhelming preference for independent study and discussion by the gifted group with the nongifted having preferred lecture and class projects. Wasson (1981) agreed with this finding as well, but added that the preference differences for independent study were significantly higher for high achieving gifted learners than for low achievers.

In his research on measured modality strengths and preferences, Barbe (1981, 1982) was able to trace an earlier shift in the gifted toward visual modality strength and ultimately toward modality integration. His studies concluded that the "mixed modality" that his gifted subjects displayed ultimate strength in and preference for might also be one answer for the better achievement evidenced by these subjects. In his work with modality, Barbe found that kinesthetic and auditory learners are least likely to perform well on standardized tests of achievement.

Consistent with Barbe's findings also, was the study of Freehill & McDonald (1981). Although their sample was small, their findings were noteworthy and of merit for replication with a more generalizable sample. They observed their gifted sample as possessing an evenness of functioning across modalities and a

coherence in behavior orientation (reality, autonomy, and psychological vitality). In essence, the researchers found the gifted to consistently rate themselves as others saw them and to place importance on autonomy rather than affiliation, especially when dealing with complex problem solving tasks. The researchers concluded that the drive to complete a given task and the drive for independence superceded their worrying about what their peers thought about them. Only two articles by Wasserman (1981,1982) differed with the findings of these researchers. Wasserman noted that on personal experience alone (no empirical evidence was cited), she found the high achieving gifted to be dependent on authority, rigid, intolerant of ambiguity, unable to take cognitive risks, anxious, oriented for one answer, and limited in personal autonomy. Although her remarks may be discounted as opinion, it would be interesting to put her opinions to empirical test.

Field Independence/Dependence. As noted in the research studies previously discussed, several authors cited the independence or autonomy of the gifted learner as a discriminating attribute of learning style. This brings us to a second major, but potentially related, difference in cognitive style: field sensitivity. Both Goodenough (1976) and Ausburn (1978) have defined this style as perceptual. Cognitive style in the perceptual sense could be one of many dimensions, the most researched being field independence/dependence -- the perceptual ability of the learner to disembed information from its context

for processing.

In an extensive literature review, Ausburn (1978) concluded that the relationships between general ability and the field independence/dependence style were too small to be significant. This study did not, however, deal directly with gifted learners, but was a generalization of the researcher's accumulated information on cognitive style. Witkin (1971, 1975, 1977) and Goodenough (1976) both alluded to the low correlation between the "verbal" and "arithmetic and digit symbol" subtests of the Wechsler Intelligence Scale, concluding that there was no correlation between intellectual ability and this cognitive style dimension. What does prove interesting in the Goodenough study (1976) were his conclusions regarding potential differentiation among gifted learners in their approaches to learning. He posited that the field independent learner tends to use a more active approach, to be more willing to test his/her own conclusions, and to be, in effect, more willing to work on his/her own. This description of field independence corresponds to Dunn & Dunn's (1980) descriptions of the independent, task-oriented gifted learner, and to Freehill & McDonald's (1981) study, which pointed to gifted learners' preferences for autonomy in problem solving. It is evident that further research needs to be carried out before one can be confident about these conclusions, but the potential connections do appear to be appropriate.

Saurenman & Michael (1980) studied the construct of field independence as a possible basis for describing the gifted

achiever and nonachiever. In studying the behavior and personality characteristics of the field dependent and field independent individual, they concluded that the field dependent has a more rigid personality, lower self-esteem and self-acceptance, and is more passive in his/her reactions to the environment. The field independent, on the other hand, was found by Saurenman & Michael to be more flexible, capable of organizing and rearranging the environment to match his/her own perceptions of it, and thus able to overcome dominance of the surroundings. In relating these findings to a study of gifted children, the researchers identified the gifted high achievers and underachievers. In testing for field independence, the researchers found that the high achieving group tended to be significantly more field independent and more interested in completing production tasks. They were also significantly more creative and divergent in their completion of these tasks. Although these findings did not differentiate between gifted and "less" gifted, they may help to explain Witkin's earlier statements about the lack of correlation between intelligence and field independence/dependence.

Locus of Control. The more passive reaction to the environment described as characteristic of the low achieving gifted student may also be related to the external versus internal locus of control dimension of cognitive learning style. Kanoy, Kanoy & Johnson (1980) have reported some research in this area. In their definition of "internal locus of control," the

team defined this orientation as resting upon the learner's belief that he/she is in control of and is responsible for the events occurring in his/her own life. The converse holds true for an "external locus of control." Two large studies have confirmed that the gifted are more likely to have an internal locus of control than nongifted populations (Kanoy et al, 1980; Milgram & Milgram, 1976). Fincham & Barling (1978) pointed to this finding as well. In administering the Nowicki-Strickland Locus of Control Scale, the researchers found that the gifted group were the least externally-oriented scorers as well as the most generous in a candy donation task. Their conclusions suggested that high internal orientation scores pointed to an established sense of personal control, feelings of self-efficacy, thus making the gifted more willing to assist others. Although this latter conclusion does not appear to agree with Dunn & Dunn's findings on less preference among the gifted for responsibility for the learning of others, it may be the nature of the generosity task itself that caused this seeming contradiction. In the donation task, children were told they could donate a piece of candy they had received as a reward for completing the tasks by putting it in a box to be forwarded to hungry, needy children. There may be a great difference between this type of donation and what the learner is being asked to donate in the classroom. The task-oriented learner may not mind giving up external, material objects, but may very much mind giving up time or energy he/she wishes to devote to learning or to the achievement of a learning

task.

Messer's findings (1972) supported what Fincham & Barling (1978) later pointed out: gifted students who scored as "internals" also scored significantly higher on achievement test and had higher grade averages. What makes the Messer study particularly noteworthy, however, is the differentiation made within the internal locus of control profile. He defined this locus as possessing two components: a willingness to take the blame for one's own failures and a willingness to take credit for one's successes. Messer found that the high achieving females in his gifted sample were much more willing to take the blame for their failures, while the high achieving males in the sample were significantly more willing to take credit for their successes.

Borland (1982) has extended the idea of cognitive style and control one step further, in his more recent work. He defined the learner's "cognitive controls" as the ego structures that mediate between the individual's drives and the demands of external reality. Cognitive style, for Borland then, becomes the superordinate ego structure combined with the interactive pattern of the learner's individual cognitive controls. Among the cognitive controls mentioned are equivilence range, field articulation, leveling-sharpening: assimilation, leveling-sharpening: accomodation, scanning, and tolerance for unrealistic experiences. These controls appear to be related to the work on cognitive styles by Witkin (1971, 1975, 1977), Ausburn (1978), and Goodenough (1976). Borland's field articulation relates to

previous discussions on field independence/dependence, and his discussions on leveling-sharpening and scanning deal with the reflectivity-impulsivity work of these same "cognitive style" researchers. What Borland has added to our general understanding of cognitive styles is his delineation of three control profiles: (1) passive-relaxed; (2) active-vigilant; and, (3) active-relaxed. One might relate Kanoy, Kanoy & Johnson's (1980) description of the "external" control locus to Borland's "passive-relaxed " control profile. The "internal" locus might be either of Borland's other two control profiles. Perhaps the difference between the latter two profiles may be the kind of differentiation described in the findings of Fincham & Barling (1978), with willingness to accept blame for failures corresponding to the "active-relaxed" control profile, and willingness to take credit for successes as one aspect of the "active-vigilant" control profile. Borland's study consisted of identifying the control profiles of 59 gifted elementary students. All three profiles were found distributed within the group; thus, the control profile itself was not a differentiating characteristic of the gifted learner, but Borland was able to identify the achieving from the nonachieving gifted through the control profile. The active-vigilant learner performed significantly better than the passive-relaxed learner on a battery of divergent production ability tests.

Hemispheric Specialization. Several researchers have looked at hemispheric specialization and cerebral dominance in gifted

and nongifted learners, often with contradictory results. Rekdal (1979) described a high correlation between superior academic achievement and a high degree of lateralization. In his studies with saccadic eye movement, he found "left movers" to score higher in verbal achievement areas and "right movers" to score more highly in mathematics achievement areas. Kershner (1981) corroborated a portion of these findings in his study of disabled and good readers among gifted learners. He found that poor readers were inferior in right-field performance compared with good readers and the gifted in general.

On the surface, Kershner's findings about right field usage seem at odds with the Rekdal findings, but the work of Olson (1978) serves to clarify this issue. In her study of visual field usage in gifted elementary students, she noted a switch at about age 9 1/2 of reading to the right visual field (hence, to left cerebral dominance). She also noted a corresponding transition of her group toward the formal operational stage at this same age. The perceptual coding strategy aspect of reading was explained as the underlying basis for the switch to the right visual field. Olson's study also pointed to the gifted learner as an earlier sorter of the visual field. Her explanations were that this sorting does not take place within the concrete operational stage, but is required for the logical thought processes of the formal operations stage. Differentiation in lateralization as far as the gifted are concerned, then, according to Olson, is not in which visual field or to which hemisphere problem solving

processes are sorted by the learner, but rather that this sorting takes place at a significantly earlier age than with average learners.

Beckman (1981) corroborated Olson's findings about sorting in her series of studies concerning spatial ability in gifted learners. Beckman found a high correlation between learners who sorted tasks according to visual field and scored highly on the WISC-R "block design" subtest. It was her conclusion that the ability to deal with inquiry was equivilent to a capacity to simultaneously process several variables and/or to deal with information analogically/globally -- all right cerebral hemispheric domains. Aliotti (1981), however, has found that learners who processed tasks in an integrated hemispheric approach were more intellectually gifted, i.e., were more successful on intellectual tasks. This leaves a big question unanswered in this review: who are the most intellectually gifted -- the sorters or the integraters? More research is definitely called for before this question can be answered.

Chen's work (1981) appears to synthesize the hemisphericity question and its relationships to giftedness. She has suggested that the concept of giftedness may be expressed on the basis of hemispheric function, with the degree of giftedness varying along the two axes of hemispheric functioning. Assuming a threshhold IQ of 130, Chen has postulated that the creatively gifted are more apt to rely on the right hemisphere for problem solving, whereas the intellectually gifted tend to use the left hemisphere more

readily for problem solving. Chen also pointed out that there are certain personality and learning traits associated with left and right cerebral dominance. The "left cerebral hemisphere" gifted learner is more likely to demonstrate: (1) higher IQ scores on the Stanford-Binet; (2) superior learning of symbolic systems and sequential analysis; (3) advanced vocabulary; (4) cautiousness and conservatism; (5) a more structured mentality; (6) outstanding self-motivation to acquire a quantity of knowledge; (7) preference for intellectual challenge and for intellectually rather than socially challenging situations. The "right cerebral hemisphere" gifted learner, on the other hand, is more likely to demonstrate: (1) superiority in visual, kinesthetic and behavioral outputs; (2) ability to assess situations intuitively; (3) more colorful vocabularies; (4) superiority in creative writing, performing, and in the visual arts; (5) an open mentality; (6) relaxed attitudes toward intellectual challenge; (7) preference for socially challenging situations; and, (8) desire to lead in such situations. Chen's concepts may hold the key to the issue of cognitive style differentiation, if it indeed exists in the gifted. It would be important that further research be done to overlay her template on the other definitions for cognitive styles, namely, learning style preference, locus of control, modality, and field articulation before any final conclusions to this question can be drawn.

Cognitive Development. Two general hypotheses appeared commonly in the Piagetian studies of cognitive development in gifted learners which were reviewed. The first was the "Similar Sequence Hypothesis", which states that all learners traverse the same stages of cognitive development in the same order, but that the gifted progress at a significantly accelerated rate within each stage, thus reaching the formal operations stage at a much earlier age. Of the eight studies reviewed in this regard, four supported this hypothesis and four rejected it. Webb (1974) studied this phenomenon in 25 gifted (IQ>160) children between the ages of 6 and 11. He found that the entire group had passed tasks at the advanced levels of the concrete operations stage well in advance of their chronological peers. His conclusions were that the speed with which tasks within a stage are mastered is a function of intelligence. He also found that only the oldest children (age 11) in his sample were able to pass the formal operations tasks. He concluded, thus, that chronological age is also a factor, to some degree, such that age eleven appeared to be the earliest age at which gifted learners enter the formal operations stage. Although this is well in advance of the normal learner, Webb could find no consistent evidence for formal operations stage precocity before age 11. Keating (1975) corroborated these findings in his studies of gifted eleven-year olds. He found that 75% of his gifted group were able to pass the formal operations tasks presented, thus lending credence to the developmental precocity implication. In a second study reported

in the same article, Keating found that those eleven-year olds who surpassed thirteen- year olds in the formal operations tasks had superior IQ's. Keating concluded that it may be more appropriate to think in terms of IQ rather than age in predicting developmental stage.

Weisz & Zigler (1979) reviewed 31 studies to test the "similar sequence hypothesis" and found 27 of them to corroborate it. The researchers labeled the remaining four studies as "weak" because of design flaws and/or small sample size. Perhaps Carter & Kontos (1982) have done the most satisfactory job of summarizing the support for this hypothesis. In their review of previous research they concluded that at the preoperational stage the gifted and nongifted learner were equivilent in task performance up to age six. The relationship between IQ and developmental level then becomes more substantial. The "within stage precocity" effect is, at that point, much more in evidence. In Carter & Kontos' own studies, the progression through concrete to formal operations was traced from ages ten to fifteen. The researchers concluded that the transition to and progress in formal operations occurs earlier in the gifted, between ages 11-13, whereas their nongifted counterparts enter formal operations around age 15.

Brown's (1973) study did not support the "similar sequence hypothesis", however. In his study of five groups with comparative mental and chronological ages, he found that children with a chronological age (CA) of 4 and a mental age (MA) of 6

performed less well on three conservation tasks at the concrete operations level than a group with CA=6, MA=6. He also found that gifted and nongifted four-year olds performed equally poorly on these tasks. Brown concluded that mental age alone cannot account for conservation performance; the experience that comes with age is a necessary condition. Brown's conclusions, however, do correlate with Carter & Kontos 1982) in that up to age six, gifted and nongifted learners do appear to be equivilent in task performance.

Rader's (1975) study brings up another problem, however. In his study, the gifted group of first graders (age 6) "topped" the Piagetian test used to assess conservation skills, and half of the average learner group did likewise. Although this would seem to support the precocity idea of the "similar sequence hypothesis", it may point to the potential invalidity of the tests used to assess each developmental level. Will paper and pencil Piagetian assessment tests produce a different set of conclusions about what the gifted can or cannot do earlier than physical manipulation tests will do? Likewise, Roberge (1976) and Kuhn (1976) found little support for the similar sequence hypothesis at the formal operations level. Roberge (1976) reported that combinatorial reasoning and conditional thinking task scores increased with grade level, regardless of IQ. Kuhn (1976, 1977) concluded that emergence of the formal operational stage is not related to IQ. She suggested that a relationship between mental age and stage level may exist before preadolescence, but at this

age, the full development and maintenance of formal operations (only reached fully by 30% of all adults) is associated strongly with the educational and cultural advantages that tend to characterize the environment of higher IQ individuals. Unfortunately, Kuhn did not include any age information on her term, "preadolescent." If the sample did contain evidence of formal operations at ages 11-12, her findings would fit with Carter & Kontos' summary. Further research to measure the percentage of formal operation high IQ's versus low IQ's at each age level from 10-15 might suggest that IQ is or is not related to formal operations precocity at the earlier ages in this span, and that the percentage of high IQ as compared to low IQ who have ultimately achieved formal operations by age 15 is equivilent, lending credence to Kuhn's environmental argument as well.

A second hypothesis about differentiated stage development in the gifted, present in several of the studies reviewed, might be termed the "Task Variability Hypothesis." This hypothesis posits that gifted learners excel in the performance of certain tasks within each stage of development. Several studies supported this hypothesis and one rejected it. DeVries (1973, 1974) in a study of 143 gifted and nongifted five, six and seven year olds, found mental age to be significantly correlated to five specific conservation tasks, but independent of successful performance on five additional tasks (including specifically, conservation of weight, identity, sorting, guessing game and transivity). Her conclusions were that two "intelligences" exist, IQ and Piagetian

stage. She further stated that Piagetian tasks do not overlap with school achievement and cannot be used to predict academic success, whereas mental age (IQ) can be used as a predictor. Although the thrust of DeVries' research was not on the second "task variability hypothesis", the fact that she was able to specify certain task correlations with IQ does support such a hypothesis.

Webb's (1974) study, previously discussed, also lends support to this second hypothesis. The tasks Webb used to assess developmental level in his gifted group were the most advanced or complex tasks at the concrete and formal operations levels. Webb concluded that those tasks which were difficult tests of a particular operations level were correlated to IQ across a wide age range. It would be interesting to assess the difficulty of the five tasks correlating to IQ as found by DeVries (1974) to see if Webb's conclusions do "hold water."

Brekke, Johnson, Williams & Morrison (1976) focused on analyzing IQ performance by Piagetian task rather than overall score; they discovered a strong correlation between Piagetian tasks and the lower levels of tasks on the IQ test. The researchers concluded that the higher intelligence test tasks deal with abstract reasoning, going far beyond the Piagetian formal operations tasks. Thus, it would be difficult to find a strong correlation between high IQ and cognitive development performance.

Kemler's (1978) work on problem-solving tasks also supported, indirectly, the "task variability hypothesis." In comparing the problem solving strategies of 7 1/2 year old gifted

and 10 1/2 year old nongifted groups, Kemler found some support for the age/stage versus mental age precocity/stage hypothesis. The older, nongifted children applied "hypothesis memory", permanently rejecting hypotheses that had failed in solving the task problem. The gifted group did not select this strategy. No significant differences in general problem solving strategies by one group or the other were noted by Kemler, but it was concluded that goal- direction and orientation may have had more influence on a learner's choice of strategy than any other factor. In other words, strategy selection differentiation might have varied due to the task to be solved rather than chronological age, mental age, or the stage at which the learner appeared to be.

Shigaki & Wolf (1979,1980, 1981, 1982) have contributed much in support of the "task variability hypothesis." In their consecutive analyses of 160 gifted children ranging in age from 4-11 years, the researchers noted a pattern of formal operations task mastery across various age groups. Their studies, have, therefore, not only looked at the sequence of task mastery, but also at the hierarchy of task difficulty. Shigaki & Wolf thus concluded that the difficulty hierarchy for class and conditional logic principles is similar for gifted and nongifted learners, but that the gifted were at least two years ahead of the nongifted in task mastery. What makes this conclusion supportive of the second hypothesis (in addition to the first one) is that the researchers found the gifted, unlike their nongifted counterparts, were not uniformly low or high across tasks

according to task difficulty. The same gifted child might score "low" on easier tasks (in comparison to the rest of the gifed group, but not to the nongifted group) and simultaneously "high" on more difficult tasks. Thus, while mean responses at each age level indicated a task difficulty hierarchy, there was much more variability of responses within the gifted group. Of interest also, was the finding by the researchers that gifted children as young as four years can generate logical conclusions for specific formal operations tasks. Much of this finding may relate back, in some way, to learning style differences concerning the structure of the content to be learned. Further research in this regard might prove interesting.

One last study by Bekey & Michael (1981) did not support the "task variability hypothesis." Bekey & Michael concluded that there was no relationship between IQ and the concrete operations or formal operations tasks they presented to their gifted and nongifted learner groups. They further stated that there was a significant relationship between chronological age and formal operations tasks. The differences they found between gifted and nongifted groups was only the inverse correlation between time needed to complete a task and IQ. A similar inverse correlation was found between task completion accuracy and time. Upon closer reading of Bekey & Michael's results, however, it is clear that 95% of the gifted fourth, fifth and sixth graders studied were able to complete two of the three formal operations tasks successfully. The researchers had given no credit for formal operations developmental processing unless all three tasks were

complete. The one task consistently missed by the subjects was the one on the use of proportions. Thus, the results of this study point out possible support for the "task variablity hypothesis" once one reads beyond the researchers' own conclusions.

Cognitive Strategy Selection . A further perspective on the nature of differences between gifted and nongifted persons is provided by Robert Sternberg. Sternberg (1980) has argued that five kinds of components must be present in human information procesing in order for humans to solve problems. The first of these is **metacomponents**, the higher-order processes used for executive planning and decision- making in problem solving. The following list enumerates several of these metacomponents in which significant differences have been found between gifted and nongifted learners. To a significantly greater degree, the gifted:

1. recognize the problem to be solved (Coleman, 1977; Kemler, 1978; Zimmerman, 1981, Mulholland, Pellegrino & Glaser, 1980; Fischer, Hunt & Randhawa, 1978; Sternberg, 1981);
2. readily generate series of solution steps (O'Connor & Hermelin, 1979; Guilford, Scheuerle & Shonburn, 1981; Zimmerman, 1981);
3. set priorities for the direction to take in solving a problem (Wong, 1983; Turner, 1980);

4. select representation of information more like an expert would (Bartkovich & Meszynski, 1980; Sternberg, 1981; Coleman, 1977);
5. decide which resources to allocate to a problem-solving task (Sternberg, 1980; Wong, 1982; Friedman & Feldhusen, 1978; Ross & Parker,1980; Zelniker, Openheimer & Renan, 1975; MacLeod, Hunt & Mathews, 1978);
6. monitor solutions systematically (Spitz, 1982);
7. take longer preconceptual time in solving a problem -- longer "front-end analysis" (Hagen, 1979; Mulholland, 1980; Hagen, 1979; Friedrich, 1974; Ludlow & Woodrum, 1980; Sternberg 7 Davidson, 1982).

A second component identified by Sternberg also shows significant differences between gifted and nongifted learners. The **performance** component includes those processes used by learners when solving problems, such as encoding, application, mapping, inference, and justification. Two major differences have been observed between gifted and nongifted learners in the use of this component in problem solving. To a significantly greater degree, the gifted:

1. execute these processes more rapidly and successfully in all tasks of <u>analogical</u> thinking (Sternberg, 1981; Miller, 1979; Zimmerman, 1981; Fischer, Hunt & Randhawa, 1978; Spitz, 1982; Carmean, 1982);
2. execute more rapidly, learn more, select more efficient strategies, and respond more rapidly and accurately in

problems dealing with memory and attention (Sternberg, 1981; Bockrath, 1981; Friedrich, 1974; O'Connor & Hermelin, 1979; Zimmerman, 1981; Fischer, Hunt & Randhawa, 1978; Spitz, 1982).

Sternberg described three other components of problem solving. Two of these components are ones on which gifted and nongifted persons have traditionally been found to be different: (1) **acquisition**, skills in learning new information; and, (2) **retention**, skills in retrieving previously acquired information. That is, in these two aspects of problem solving and information processing, the gifted learn more and retain more than their nongifted counterparts. The third component, labeled **transfer** by Sternberg, has had some recent research on potential differences between gifted and nongifted learners. The gifted have been found to significantly differ in (1) their ability to analyze, synthesize with and evaluate newly acquired information (Ward, 1980), and in (2) their decontextualization skills in constructing solutions to new problems requiring transfer of previously learned strategies and content (Sternberg, 1981; Jensen, 1979).

Social and Emotional Characteristics. For emotional and social characteristics associated with the academic setting, significant differences among gifted and nongifted populations were also found. Gifted students tended to have higher concepts of themselves as learners than do others, especially if they have been placed in high-ability groupings or programs (Ketcham &

Snyder, 1977; Rogers, Smith & Coleman, 1970; Kanoy, Johnson & Kanoy, 1980; Johnson & Yarborough, 1978; Stopper, 1979; Milgram & Milgram, 1976; Coleman & Fults, 1982; Feldhusen & Kolloff, 1981; Michael, 1977). This high academic self-concept tended to decrease with age, however, such that by the high school years, gifted students do not vary significantly from nongifted in how they view themselves as learners (Klein & Cantor, 1976; Stopper, 1979; Milgram & Milgram, 1976). Some contradictions were found in the research when the variable of achievement level was introduced, however. Schunk & Lilly (1982) found that low achieving gifted students tended to rate their ability to solve tasks and the effort put forth to solve such tasks more highly than did high achievers. Fine & Pitts (1980), on the other hand, concluded that underachieving gifted students tended to have much lower patterns of self- esteem. In Dean's (1977) study, high achievers on a concept mastery test exhibited the highest self-concept scores as well. Klein & Cantor (1976) found that when gifted learners were controlled for age and achievement,however, a significantly larger percentage had low self-esteem as compared with their nongifted peers. King (1981) found differences among the gifted in their self- concepts depending on the area in which giftedness was displayed. In her study, both male and female gifted students perceived as leaders by their teachers were significantly lower in self- concept than were their nongifted counterparts. Gifted students perceived by their peers to be scientific had significantly higher self- concepts than their

nongifted classmates. King also discovered that peers generally correlated perceived giftedness with high self-concept, whereas teachers generally associated giftedness with a low self-concept. It is evident in this discussion that much more research needs to be done to find the common thread among variables associated with self- concept and esteem. One obvious difference among the studies reviewed here was the different self-concept scales used to measure self-concept or esteem, none of which seemed to correlate very positively with other scales. This may have helped to account for the wide variance in results.

In interpersonal sensitivity, the gifted showed superiority in reading the feelings of others toward themselves in the school setting. Ritchie (1978) and Perez (1980) have both reported that this sensitivity exhibits itself at a much earlier age in the gifted. In later work with Bernard and Shertzer, Ritchie found that this interpersonal sensitivity continued to be significantly greater in gifted learners as they grew older and was present in several types of interpersonal interactions: adult/adult, adult/child, and child/child (Ritchie, Bernard & Shertzer, 1982). Furthermore, Kaiser (1981) found the gifted were significantly more confident of their sensitivity in interpersonal interactions than were nongifted learners at the college level. Puckett (1980) described the superiority of gifted children in identifying (1) nonverbal cues, (2) positive-submissive behaviors, and (3) negative-dominant behaviors in teachers. Abroms (1981) looked at the perspective-taking of gifted and nongifted children,

concluding that the gifted possess significantly higher levels of affective, visual, and conceptual perspective- taking even at very young ages. That is, the gifted were more able to empathize, to perceive objects from unusual perspectives, and to understand new and unusual ideas.

For social cognition, the ability to get along with others and to manage social situations in the academic setting, the gifted have also been shown to have the advantage. Several studies have pointed out that the gifted exhibit prosocial behavior and social skills at an earlier age than do the nongifted (Abroms & Gollin, 1980; Jordan, 1980; Scott & Bryant, 1978; Roedell, 1978; Austin, Berghout & Draper, 1981; Lehman & Erdwins, 1981). Furthermore, social acceptance was reported to be significantly higher for the gifted so long as their measured IQ's remained below 150 (Austin, Berghout & Draper, 1981). Beyond that threshhold, teachers reported that the gifted were less popular and socially accepted than their nongifted counterparts (Austin, Berghout & Draper, 1981). Finally, attitudes toward learning were found to be more favorable among gifted students than for other groups (Bracken, 1979; Ross & Parker, 1980; King, 1981).

Differences in the emotional characteristics between gifted and nongifted students were also found to be marked. The gifted were significantly higher in:

1. intellectence, a preference for abstract thinking (Welsh, 1978; Michael, 1977);

2. emotional stability (Welsh, 1978; Michael, 1977; Eysenck, 1983);
3. motivation, as rated by teachers (Welsh, 1978; Johnson & Yarborough, 1978);
4. general emotional health (Reynolds & Bradley, 1982; Michael, 1977);
5. confidence in interpersonal interactions (Kaiser, 1981);
6. sense of personal worth (Lehman & Erdwins, 1981; Milgram & Milgram, 1976);
7. sense of personal freedom (Lehman & Erdwins, 1981; Michael, 1977);
8. antisocial tendencies (Lehman & Erdwins, 1981; Eysenck, 1983);
9. willingness to cooperate (Lehman & Erdwins, 1981; Michael, 1977).

Correspondingly, the gifted were found to be significantly lower in the following emotional characteristics:

1. levels of anxiety (Reynolds & Bradley, 1982; Eysenck, 1983);
2. nervous symptoms (Lehman & Erdwins, 1981);
3. willingness to compromise (Lehman & Erdwins, 1981).

Discussion

In reviewing the characteristics suggested as typical of gifted students, it is important to keep in mind that knowledge in this area is far from complete. It may be possible to draw up

a portrait of gifted students using many of the descriptions which emerge from this research review, but such a portrait would be inaccurate for many gifted individuals. Not every gifted child will exhibit all of these characteristics, and, indeed, these characteristics are not exclusive to gifted students. Rather, they are dimensions of ability, development and attitudes on which gifted students tend to be favored. In the main, these differences are quantitative rather than qualitative. Big quantitative differences tend to produce qualitative differences over time, however. In answer to the general question upon which this review was undertaken, i.e., do gifted students learn and think differently or is their giftedness a difference of degree rather than kind, the answer must be that the differences are probably ones of degree. Persons who show extraordinary abilities are not of a different order. They can be understood in the same terms as average persons, except that in the dimensions used to describe human beings the gifted are at one extreme. It is true, of course, that quantitative differences taken at extremes do seem to be qualitative as well. Furthermore, gifted persons have different patterns of experience and success in school and in life in general. This undoubtedly leads to discernible differences of many kinds among the gifted.

Once the assumption has been made that there are potential, quantitative differences in the gifted learner, it follows that there must be a set of implications for educators which stem from these differences. In general it is safe to say there appear to

be some critical elements that may help to provide the kind of environment in which giftedness may fully develop. Professor Daniel Keating (1982), among others, has suggested four components which fit rather well with the ideas suggested by this review. It will take more research, however, to determine whether or not these four components really do make a difference.

Component One: Exposure to Content. Gifted students with discernible differences in their ability to acquire and process information must be allowed to become "experts" in those domains where their specific proclivities lie. In surveying the majority of current gifted programming attempts, this appears to be the component most likely to be missing. Yet, Feldman (1980) and Perkins (1983), in particular, have argued that we cannot create new solutions or products until the old content surrounding a problem has been "mastered." There have been some masterful attempts at providing students gifted in specific academic areas with in-depth, accelerated content, such as the Johns Hopkins Study for Mathematically Precocious Youth program and its various replications across the country, and the "Talent Search" efforts, based on this idea.

Component Two: Practice in Divergent Thinking. Although we cannot make very reliable predictions that such creative thinking skills as fluency, flexibility, elaboration, originality, risk-taking, curiosity, complexity and imagination lead directly to creative solutions, the research has shown a link between ideational fluency, creative problem solving, and problem finding and one's

inclination to think creatively (Perkins, 1983). There are a variety of national programs that allow gifted students to practice with divergent thinking, including "Creative Problem Solving, Synectics, and Future Problem Solving Bowl. The Williams Cognitive-Affective Interaction Model (Williams, 1978) is an excellent curriculum development model for integrating creative thinking skills into most content areas.

Component Three: Critical Analysis Techniques. Opportunity to practice analyzing and evaluating what has been learned or produced from learned information is critical for gifted students. In this respect, we are in the middle of a burgeoning of "critical thinking skills" programs, many of which are highly appropriate for gifted learners. The new emphasis on metacognition, which many of these programs advocate, will particularly aid the gifted learner in developing his/her higher order planning and decision-making processes (metacomponents). Sternberg (1984) described just a few of these programs in his article, " How Can We Teach Intelligence?", and the Association for Supervision and Curriculum Development (ASCD) has recently published a book describing 15 "thinking skills programs (Brandt, 1985). In addition there are several curriculum development models which integrate appropriate thinking skills development into most content areas, including Taba's Teaching Strategies Model, Bloom's Taxonomy of Cognitive Objectives, and Kohlberg's Moral Development Model.

Component Four: Communications Skills Development. Practice with the fashioning of products or vehicles of communication for new ideas and solutions to problems is also critical for gifted learners exhibiting high degrees of the performance and transfer components of intellectual processing. Again, many schools are providing for these types of skills through programs such as "Olympics of the Mind", Inventors' Fairs, Science Fairs, and Creative Problem Solving. "Project Reach" activities, especially those based on Taylor's Communication and Planning talents, are also useful in the development of needed communication skills.

As educators, the primary goal of what is chosen to be done for gifted learners must not be to foster nor to encourage the differences reviewed in this study, but rather to meet the special needs or problems these differences may create. This is where the bulk of future research efforts must lie.

References

Abroms, K.I. (1981). Birth cry to five: Milestones in the psychosocial development of the gifted. EC 140334.

Abroms, K.I. & Gollin, J.B. (1980). Developmental study of gifted preschool children and measures of psychosocial giftedness. Exceptional Children, 46 (5), 334-341.

Austin, A.B. & Draper, D.C. (1981). Peer relationships of the academically gifted: A review. Gifted Child Quarterly, 25 (3), 129-133.

Barbe, W.B. & Milone, M.N. (1982). What we know about modality strengths. Educational Leadership, 38, 378-380.

Barbe, W.B. & Milone, M.N. (1982). Modality characteristics of gifted children. Gifted Child Quarterly, 21, 2-6.

Barling, J. & Fincham, F.D. (1978). Performance standards in learning disabled, normal and gifted children: A pilot study. Journal of Behavioral Science, 2 (5), 307-308.

Beckman, L. (1981). Spatial ability: A necessary element for intellectual gifted functioning. Roeper Review, 4 (1), 12-13

Bekey, S.W. & Michael, W.B. (1981). The performance of gifted upper elementary school girls on Piagetian tasks of concrete and formal operations. EC 140096.

Bockrath, D.A. (1981). The relationship between reaction time and both intelligence and achievement in normal, gifted, emr, and ld populations. Dissertation Abstracts International, 41 (8-A), 3484.

Borland, J.H. (1982). Cognitive controls, cognitive styles, and divergent production among gifted preadolescents. Dissertation Abstracts International, 42, (9-A), 3943.

Bracken, P.A. (1980). Comparison of self-attitudes of gifted children and children in a nongifted normative group. Psychological Reports, 47 (3, part 1), 715-718.

Brekke, B., Johnson, L., Williams, J.D. & Morrison, E. (1976). Conservation of weight with the gifted. Journal of Genetic Psychology, 129, 179-184.

Brown, A.L. (1978). Conservation of number of continuous quantity in normal, bright, and retarded children. Child Development, 44 (2), 376-379.

Burk, E.A. (1980). Relationship of temperamental traits to achievement and adjustment in gifted children. Ann Arbor, MI.: University Microfilms International.

Carmean, M.K. (1982). A study of the relationship of cognitive style with selected intellectual abilities utilized by gifted students in problem solving. Dissertation Abstracts International, 42 (8-A), 3548.

Carter, K.R. & Kontos, S. (1981). The application of developmental theories. Roeper Review, 4 (1),17-20.

Carter, K.R. & Ormrod, J.E. (1982). Acquisition of formal operations by intellectually gifted children. Gifted Child Quarterly, 26 (3), 110-115.

Chen, A.W. (1981). Brain-hemisphere functions as a basis for giftedness. Roeper Review, 4 (1), 6-17.

Childs, R.E. (1981). A comparison of the adaptive behavior of normal and gifted five and six year old children. Roeper Review, 4 (2), 41-43.

Cole, R.F. (1980). Cerebral specialization in exceptional children. Dissertation Abstracts International, 41 (6-A), 2250.

Coleman, J.M. & Fults, B.A. (1982). Self-concept and the gifted classroom: The role of social comparisons. Gifted Child Quarterly, 26 (3), 116-120.

Coleman, N.C. (1977). Learning and comprehension of simultaneously presented stimuli in children of normal and superior intelligence. Dissertation Abstracts International, 38 (3-A), 1296.

Cook, N.L. (1976). The acquisition of dimensional adjectives as a function of the underlying perceptual event. Dissertation Abstracts International, 38 (5-B), 2475-2476.

Dean, R.S. (1977). Effects of self-concept on learning with gifted children. Journal of Educational Research, 70 315-318.

DeVries, R. (1973). Performance of Piaget-type tasks of high iq, average iq and low iq in children. ED 086374.

DeVries, R. (1974). Relationships among Piagetian iq and achievement assessments. Child Development, 45 (3), 746-756.

Dunn, R.S. & Price, G.E. (1980). The learning style characteristics of gifted students. Gifted Child Quarterly, 27 (3), 122-125.

Dunn, R., Dunn, K. & Price, G.E. (1981). Learning styles: Research vs. opinion. Phi Delta Kappan, 62, 645-646.

Eysenck, H.J. (1983). The roots of creativity: Cognitive ability or personality trait? Roeper Review, 10-12.

Feldhusen, J.F. & Kolloff, M.B. (1981). ME: A self-concept scale for gifted students. Perceptual and Motor Skills, 53 (1), 319-323.

Feldman, D.H. (1980). Beyond universals in cognitive development. Norwood, N.J.: Ablex.

Fincham, F. & Barling, J. (1978). Locus of control and generosity in learning disabled, normal achieving, and gifted children. Child Development, 49 (2), 530-533.

Fine, M.J. & Pitts, R. (1980). Intervention with underachieving gifted children: Rationale and strategies. Gifted Child Quarterly, 24, 51-55.

Finger, P.T. (1982). The measurement of locus of control in gifted and nongifted students. EC 142761.

Fischer, D.G., Hunt, D. & Randhawa, B.S. (1978). Empirical validity of ertl's brain-wave analyzer. Educational and Psychological Measurement, 38 (4), 1017-1030.

Freehill, M.F. & McDonald, J. (1981). Zeal: Essential to superior intellectual achievements? Gifted Child Quarterly, 25 (3), 123-127.

Friedrich, D. (1974). Slow-learner, average and gifted third graders: Strategy analysis and training for learning. Psychology in the Schools, 11 (3), 344-350.

Fuqua, R.W., Bartsch, T.W. & Phye, G.D. (1975). An investigation of the relationship between cognitive tempo and creativity in preschool-age children. Child Development, 46, 779-782.

Glenn, P.G. (1978). The relationship of self-concept and iq to gifted students' expressed need for structure. Dissertation Abstracts International, 38 (7-A), 4091.

Griggs, S.A. & Price, G.E. (1980). A comparison between the learning styles of gifted versus average suburban junior high school students. Roeper Review, 3, 7-9.

Guilford, A.M., Scheurle, J. & Shonburn, S. (1981). Aspects of language development in the gifted. Gifted Child Quarterly, 25 (4), 159-163.

Hagen, J.C. (1979). Concept formation in average, gifted and highly gifted children. Dissertation Abstracts International, 39 (12-A), 7281.

Hermelin, B. & O'Connor, N. (1980). Perceptual, motor and decision speeds in specifically and generally gifted children. Gifted Child Quarterly, 24 (4), 180-185.

Hollinger, C.L. (1983). Counseling the gifted and talented female adolescent: The relationship between social self-esteem and traits of instrumentality and expressiveness. Gifted Child Quarterly, 27 (4), 157-168.

Hollingsworth, L. (1976). The development of personality in highly intelligent children. In The intellectually gifted: An overview. N.Y.: Grune & Stratton.

Jensen, A.R. (1979). G: Outmoded theory or unconquered frontier? Creative Science and Technology, 2, 16-29.

Johnson, R.A. & Yarborough, B.H. (1978). The effects of marks on the development of academically talented elementary pupils. Gifted Child Quarterly, 22 (4), 498-505.

Jordan, V. (1980). Conserving kinship concepts: A developmental study in social cognition. Child Development, 51, 146-155.

Kaiser, C.F. (1981). Differences between gifted adolescents and their peers on a measure of self-actualization. EC 133596.

Kanoy, R.C., Johnson, B.W. & Kanoy, K.W. (1980). Locus of control and self-concept in achieving and underachieving bright elementary students. Psychology in the Schools, 17 (3), 395-399.

Keating, D.P. (1975). Precocious cognitive development at the level of formal operations. Child Development, 46 (1), 276-280.

Kemler, D. (1978). Patterns of hypothesis testing in children's discriminative learning: A study of the development of problem solving strategies. Developmental Psychology, 14, 653-673.

Kershner, J.R. (1977). Cerebral dominance in disabled readers, good readers and gifted children: Search for a valid model. Child Development, 48 (1), 61-67.

Ketcham, R. & Snyder, R.T. (1977). Self-attitudes of the intellectually and socially advantaged student: Normative study of the Piers-Harris children's self-concept scale. Psychology Reports, 40, 111-116.

King, M.L. (1981). Self-concept as it is related to degrees of environmental support, environmental availability, giftedness and delinquency proneness. EC 140696.

Klein, P.S. (1980). Right and left hemispheres represent two modes of learning: The overlooked or misused talents of learning disabled children. Creative Child & Adult Quarterly, 5 (1), 98-101.

Klein, P.S. & Cantor, L. (1976). Gifted children and their self-concept. Creative Child and Adult Quarterly, 1, 30-34.

Kuhn, D. (1976). Relation of two Piagetian stage transitions to iq. Developmental Psychology, 12, 157-161.

Lehman, E.B. & Erdwins, C.J. (1981). The social and emotional adjustment of young intellectually gifted children. Gifted Child Quarterly, 25 (3), 134-137.

Ludlow, B.L. & Woodrum, D.T. (1982). Problem-solving strategies of gifted and average learners on a multiple discrimination task. Gifted Child Quarterly, 26 (3), 99-104.

Lundy, J.R. (1981). Cerebral hemisphere specialization, imagery, creative imagination, and sex differentiation. Roeper Review, 4 (1), 14-17.

Lynne, J.H. (1979). A comparison of the locus of control of children in the gifted and average ranges of intelligence. Dissertation Abstracts International, 40 (8-A), 4467-A.

MacLeod, C.M., Hunt, E.B. & Mathews, N.N. (1978). Individual differences in the verification of sentence-picture relationships. Journal of Verbal Learning and Verbal Behavior, 17, 493-507.

Maddox, C.D., Scheiber, L.M. & Bass, J.E. (1982). Self-concept and social distance in gifted children. Gifted Child Quarterly, 26 (2), 77-80.

Messer, S.B. (1972). The relation of internal-external control to academic performance. Child Development, 43 (4), 1456-1462.

Michael, W.B. (1977). Cognitive and affective components of creativity in mathematics and the physical sciences. In The gifted and the creative: A fifty-year perspective. Baltimore, MD.: The Johns Hopkins University Press, 141-171.

Milgram, R.M. & Milgram, N.A. (1976). Personality characteristics of gifted Israeli children. Journal of Genetic Psychology, 129, 185-194.

Milgram, R.M. & Milgram, N.A. (1976). Self-concept as a function of intelligence and creativity in gifted Israeli children. Psychology in the Schools, 13, 91-96.

Miller, G.D. (1980). Who is gifted? A quick grasp of concepts is one clue. Independent School, 39 (4), 12-16.

Mulholland, T.M., Pellegrino, J.W. & Glaser, R. (1980). Components of geometric analogy solutions. Cognitive Psychology, 12, 252-284.

O'Connor, M. & Hermelin, B. (1979). Intelligence differences and conceptual judgment. Psychological Research, 41, 91-100.

Olson, M.B. (1977). Right or left hemispheric information processing in gifted students. Gifted Child Quarterly, 21 (1), 166-121.

Olson, M.B. (1978). Visual field usage as an indicator of right or left hemispheric information processing of gifted students. Gifted Child Quarterly, 22 (2), 243-247.

Perez, G.S. (1980). Perceptions of the young gifted child. Roeper Review, 3 (2), 9-11.

Price, G.E., Dunn, K., Dunn, R. & Griggs, S.A. (1981). The learning styles of gifted versus average suburban junior high school students. Roeper Review, 3 (2), 38-40.

Puckett, D. (1980). An investigation of the nonverbal sensitivity of academically talented, average, and learning disabled students. Dissertation Abstracts International, (3-A), 1022.

Rader, J.R. (1975). Piagetian assessment of conservation of skills in the gifted first grader. Gifted Child Quarterly, 19 (3), 226-229.

Reynolds, C.R. & Bradley, M. (1982). Emotional stability of gifted children as estimated by chronic anxiety levels. EC 142499.

Ritchie, A.C., Bernard, J.M. & Shertzer, B.E. (1982). A comparison of academically talented children and academically average children on interpersonal sensitivity. Gifted Child Quarterly, 26 (3), 105-109.

Roberge, J.J. (1976). Developmental analysis of two formal operational structures: Combinatorial thinking and conditional reasoning. Developmental Psychology, 12 (6), 563-564.

Roberts, D.J., Carter, K.R. & Mosley, D. (1982). A comparison of the perceptions of gifted children and their parents. Gifted Child Quarterly, 24, 46-50.

Roedell, W.C. (1978). Social development in intellectually advanced children.

Rogers, C.M., Smith, M.D. & Coleman, J.M. (1978). Social comparison in the classroom: The relationship between academic achievement and self-concept. Journal of Educational Psychology, 70, 50-57.

Rosenfield, S. & Houtz, J.C. (1978). Developmental patterns in problem-solving and divergent thinking abilities in gifted elementary school children. Journal for the Education of the Gifted, 1 (2), 37-48.

Ross, A. & Parker, H. (1980). Academic and social self-concepts of academically gifted. Exceptional Children, 47, 6-10.

Rekdal, C.K. (1978). Hemispheric lateralization, cerebral dominance, conjugate saccadic behavior, and their use in identifying the creatively gifted. Gifted Child Quarterly, 23 (1), 101-108.

Saurenman, D.A. & Michael, W.B. (1980). Differential placement of high-achieving and low-achieving gifted pupils in grades four, five, and six on measures of field dependence-field independence, creativity, and self-concept. Gifted Child Quarterly, 24 (2), 81-85.

Schunk, D.H. & Lilly, M.W. (1982). Attributional and expectancy change in gifted adolescents. EC 142758.

Scott, E. & Bryant, B. (1978). Social interaction of reading and nonreading kindergarten students with high intellectual ability. Catalog of Selected Documents in Psychology, 8, 95.

Shigaki, I.S. & Wolfe, W.W. (1980). Formal syllogistic reasoning of young gifted children. ED 188376.

Shigaki, I.S. & Wolfe, W.W. (1980). Hierarchies of formal syllogistic reasoning of young gifted children. Child Study Journal, 10, 87-106.

Shigaki, I.S. & Wolfe, W.W. (1982). Normal and gifted children's class and conditional logic. EC 142760.

Spitz, H.H. (1982). Intellectual extremes, mental age and the nature of human intelligence. Merrill-Palmer Quarterly, 28 (2), 167-192.

Sternberg, R.J. (1981). A componential theory of intellectual giftedness. Gifted Child Quarterly, 25 (2), 86-93.

Sternberg, R.J. (1984). How can we teach intelligence? Educational Leadership, 42, 38-48.

Sternberg, R.J. (1981). Intelligence and nonentrenchment. Journal of Educational Psychology, 73, 1-16.

Sternberg, R.J. (1978). Intelligence research at the interface between differential and cognitive psychology. Intelligence, 2, 195-222.

Sternberg, R.J. (1982). Lies we live by: Misapplication of tests in identifying the gifted. Gifted Child Quarterly, 26 (4), 157-161.

Sternberg, R.J. & Davidson, J.E. (1982). The mind of the puzzler. Psychology Today, 16, 37-44.

Stewart, E.D. (1981). Learning styles among gifted/talented students: Instructional technique preferences. Exceptional Children, 48 (2), 134-138.

Stopper, C.J. (1979). The relationships of the self-concept of gifted and nongifted elementary school students to achievement, sex, grade level, and membership in a self-contained academic program for the gifted. Dissertation Abstracts International, 40, 90-A.

Turner, S.T. (1980). Clustering in free recall tasks in normal and exceptional children. Dissertation Abstracts International, 40 (7-A), 3960.

Ward, M.G. (1980). Differences in the ability levels and growth gains in three higher cognitive processes among gifted and nongifted sixth grade students. Dissertation Abstracts International, 40 (7-A), 3860.

Wasserman, S. (1982). The gifted can't weigh that giraffe. Phi Delta Kappan, 63 (9), 621-624.

Wasson, F.R. (1981). A comparative analysis of learning styles and characteristics of achieving and underachieving gifted elementary students. Dissertation Abstracts International, 41 (9-A), 3993.

Webb, R.A. (1974). Concrete and formal operations in very bright 6 to 11 year olds. Human Development, 17 (4), 292-300.

Weisz, J.R. & Zigler, E. (1979). Cognitive development in retarded and nonretarded persons: Piagetian tests of the similar sequence hypothesis. Psychological Bulletin, 86 (4), 831-851.

Welsh, G.S. (1978). Personality correlates of intelligence and creativity in gifted adolescents. In The gifted and the creative: A fifty-year perspective. Baltimore, MD.: The Johns Hopkins University Press, 11-22.

Wolfe, W.W. & Shigaki, I.S. (1981). Conditional logic of young gifted children. ED 192480.

Wolfe, W.W. & Shigaki, I.S. (1983). A developmental study of young gifted children's conditional reasoning ability. Gifted Child Quarterly, 27 (4), 173-179.

Wong, B.Y.L. (1982). Strategic behaviors in selecting retrieval cues in gifted, normal achieving and learning disabled children. Journal of Learning Disabilities, 15 (1), 33-37.

Woodrum, D.T. (1979). A comparison of problem solving performances for 4th, 5th and 6th grade children classified as normal, gifted, or learning disabled and by focusing level and conceptual tempo. Dissertation Abstracts International, 39 (11-A), 6708-6709.

Zaffrann, R.T. (1976). A case study approach to and understanding of factors affecting the development of locus of control in gifted and talented adolescents. Ann Arbor, MI.: University Microfilms International.

Zelniker, T., Openheimer, L. & Renan, A. (1975). Effect of dimensional salience and salience of variability in problem solving: A developmental study. Developmental Psychology, 2, 334-341.

Zimmerman, B.L. 91981). Individual differences in intelligence and learning. Dissertation Abstracts International, 42 (2-A), 625-626.

Ziv, A.R.J. & Doni, M. 91977). Parental perception and self-concept of gifted and average underachievers. Perceptual and Motor Skills, 44, 563-568.

Table 1. Number of research studies according to review question category.

QUESTION CATEGORY	NUMBER OF RESEARCH STUDIES
Cognitive Style	42
Cognitive Development	18
Cognitive Strategy Selection	46
Social, Emotional Factors	56